

# NASA TECH BRIEF

## *Marshall Space Flight Center*



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### Particle-Fluid Interactions For Flow Measurements

Turbulent flow characteristics can be measured by suspending small particles in the fluid under study and tracking the movement of the particles. The motion of the particles is determined by a laser-Doppler flowmeter. The particles must be small compared to scale of turbulence if they are to respond to all the turbulence components of the fluid, for large particles will follow only the slow, large-scale movements. To accurately correlate the particle motion with the turbulent flow, the interaction between the particle and the fluid must be well understood.

A study has been made of the motion of a single particle and of a group of particles, emphasizing solid particles in a gaseous fluid. The velocities of the fluid and of the particle are compared for several conditions of physical interest. The mean velocity and velocity fluctuations are calculated for a single particle, and some consideration is given to multiparticle systems. The motion of a single particle is a simplified case of dilute gas/solid suspension flow. For a large number of particles, the energy spectrum of the fluid is modified, since lags between the particle and fluid motion contribute to energy dissipation.

It was concluded that small particles (less than one micron) can be used to measure fluid motions except under high-frequency fluctuations. At high velocities and for detailed analysis of turbulence, all particle-fluid-instrument interactions must be considered.

#### Notes:

1. The study also contains a discussion of the theory of particle-fluid interactions, the effects of simplifying assumptions, a review of experimental work, and a bibliography.
2. Requests for further information may be directed to:  
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Marshall Space Flight Center  
Code A&PS-TU  
Marshall Space Flight Center, Alabama 35812  
Reference: B73-10117

Source: N. S. Berman of  
Arizona State University  
under contract to  
Marshall Space Flight Center  
(MFS-21727)